

Crystal ball: Calorimetry calculations

All of the following questions have not (as yet!) appeared in the NCEA Level 2 Exams

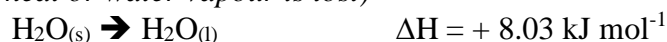
Additional information: The specific heat capacity of water = $4.18 \text{ J g}^{-1} \text{ }^{\circ}\text{C}^{-1}$

1) A simple calorimeter was used in the lab to determine the $\Delta_c H^{\circ}$ ($\text{CH}_3\text{OH} (l)$)

i) Write an equation for the combustion of methanol.

ii) 2g of methanol was combusted in the spirit burner, resulting in an increase in temperature of 12mL of water from 22°C to 57°C . Calculate the heat of combustion of methanol

2) i) How much energy would have to be produced by a butane camping cooker to melt a cup (350g) of ice? (*Assume that no heat or water vapour is lost*)



ii) 1 mole of butane releases 2874kJ of heat. How many moles of butane will be required to melt the ice in (c) above? (*again assume no heat or water vapour is lost*)

iii) How many grams of butane is required to heat the 350g of ice (at 0°C) until it becomes hot water (at 90°C)? (*again assume no heat or water vapour is lost*)

3) In industry solutions are often quoted in weight per volume (w/v), so a 10% solution w/v would contain 10g of solute per 100mL of solution.

25.0mL of a 20% w/v NaOH solution with a density 1.2191 g mL^{-1} is added to 75.0mL of water. This raises the temperature of the water from 20°C to 27°C .

i) Calculate the heat of reaction.

ii) Calculate the enthalpy change in kJ mol^{-1} . $M_r (\text{NaOH}) = 40 \text{ g mol}^{-1}$

4) 5g of ethanol is combusted in a spirit burner. 4 kJ are absorbed by a certain mass of water, the temperature of the water increases from 15°C to 80°C . Calculate the **mass** of the water sample. (*Assuming that there is no heat or water vapour loss*)